

### **3.7 TATCHIM ISUA**

#### **3.7.1 □ Location and Site Description – Tatchim Isua**

The Tatchim Isua site is situated approximately 0.2 miles north of the lagoon and 9 miles north of the existing village. The site is on a bluff about 1.7 miles east of the Chukchi Sea and approximately 40 ft above the small Asikpak Lagoon located near the toe of the western slope.

The site is treeless and has little vegetative coverage. The ground within 400 ft of the bluff is dry and solid to walk on. The surface shows gravel through a thin covering of Arctic Willow.

The Tatchim Isua site is comprised of a maximum of 40 acres of the solid, dry gravelly material, which tapers out to wetter tundra on the north and west. The east and southern edges of the site are characterized by bluff faces rising gently off the lagoon below for a hundred yards, and then becoming steeper within a hundred feet of the shoulder of the site. The immediate bluff slopes rise at about a 45-degree angle for the last 35 ft.

The surface of the site slopes to the South and West over a distance of about a ½ mile. The tundra slope above the gravel site is extensive. Slopes are in the 5%-8% range with lower grades to the southeast and northwest for distances of up to 800 yards to drainage courses flowing south and west.

The faces of the bluffs on the western and southern sides are sparsely covered with scrub willow.

Reference Appendix B for geotechnical borings at the site. Eight borings were drilled in 2005. The results showed that ice rich silt was encountered 20 feet down on one of the borings, and a layer of massive ice was located on the lower bench (Shannon & Wilson, 2005).

#### **3.7.2 □ Site Development – Tatchim Isua**

Reference the geotechnical report regarding the depth of gravel recommended in maintaining the thermal regime of the site after development. The depth of fill applied to the site will be determined by two criteria: adequate fill to facilitate buried utilities where feasible, and the required grading to promote adequate drainage throughout the site.

The fill depth over this site will vary depending on the type of subgrade soil it is placed on. We anticipate that fill should be 3 ft, deeper in those areas of poor soils, and no fill required in the more dry, more stable subgrade soils.

Grading should maximize the utilization of swales and roadside ditching. Where lengths of grade and slopes combine to make swales and ditches too deep, drainage structures such as culverts, manholes, catch basins and subsurface piping shall be employed.

A benefit of developing this site is that it is landlocked and does not require protective armor rock to ensure against erosion; however the barge landing will require erosion protection.

##### **3.7.2.1 Construction Considerations – Tatchim Isua**

If bedrock is relatively shallow and overlain by a thin layer of soil, larger structures could be founded on conventional foundation systems, and residential structures could be founded post-and-pad or conventional shallow systems (S&W, 2004).

General site preparation for structures might involve building a level pad, and then replacing the surficial frost-susceptible or thaw-unstable soils with stable nonfrost susceptible fill (S&W, 2004).

### **3.7.3 □ Infrastructure Development – Tatchim Isua**

#### **3.7.3.1 Water – Tatchim Isua**

The most probable water source for Tatchim Isua is the Asikpak River (see Appendix H). Another small creek flows through the site, but it is not known if it flows year-round.

A belowground distribution system would be feasible at the Tatchim Isua site. S&W (2005) indicates that water utilities could be directly buried in the weathered rock and soil, or in a thin pad at the site.

#### **3.7.3.2 Wastewater – Tatchim Isua**

Tatchim Isua has a slope of less than 3% and large gravel pads. In the upper bench of land, and the area above the upper bench, the subsurface conditions show relatively shallow, weathered bedrock. Sewer utilities could be directly buried in the weathered rock and soil, or in a thin pad. The buried utilities would not be impacted by large differential movements due to permafrost thawing (SW 2005). If facilities are installed in the upper bench of land, a vacuum collection system and an underground arctic pipe system should be recommended. The available space allows for a sewage lagoon at this site.

Instability concerns with lagoon construction are expected to be minimal. Lakes at the base of the hill might be considered for wastewater treatment and disposal. On-site wastewater disposal with a leach field would not be appropriate due to shallow bedrock and frozen ground.

#### **3.7.3.3 Solid Waste – Tatchim Isua**

The Tatchim Isua site and its respective potential solid waste sites are well above the flood plain at an elevation of approximately 75 feet. The nearest flood plain is at the foot of the western bluff. There is minimal potential for surface water to enter the site.

A potential solid waste site is located on gently rolling hills about 0.5 to 2 miles southeast of the site. This area appears to have the capacity to support a solid waste site, but may have shallow ice. Fill soil would be needed to develop this site (TNH 2004). Drainage of the existing soil was poor during the 2004 site visit, and a visual inspection indicated silty and wet ground. Borrow material for covering landfill debris would have to be brought in from other locations.

#### **3.7.3.4 Fuel – Tatchim Isua**

Except for the location of marine headers and fill pipeline routings, the information in 3.2.6 Fuel applies to all potential sites equally.

#### **3.7.3.5 Heating – Tatchim Isua**

The information in 3.2.7 Heating applies equally to all sites.

#### **3.7.3.6 Electricity – Tatchim Isua**

The information in 3.2.8 Electricity applies equally to all sites.

### **3.7.4 □ Access – Tatchim Isua**

Road access to the Tatchim Isua site is required to allow for barge landing and transfer of materials to the site. Figure 9 shows a proposed 1.5 mile long road from a barge landing area on the Chukchi Sea to the town site. The road would be gravel, with 5 feet of fill and 2:1 side slope shoulders. Geotextile fabric would be placed at the base of the road between the gravel fill section and the tundra.

#### **3.7.4.1 Access for Subsistence Activities – Tatchim Isua**

Access to the Chukchi Sea and its beaches for hunting sea mammals and fishing should be across a half mile of the 1.5 mile long barge landing road. All harvested game and equipment needed for subsistence activities

may need to be hauled across the village access road to the barge landing area.

Access to the Kivalina and Wulik Rivers would be from the Kivalina Lagoon. The Kivalina Lagoon is reported to be very shallow in the vicinity of Tatchim Isua. To access the deeper areas of the lagoon, boat traffic would have to follow the coast from the barge landing area to one of the inlets to the lagoon, then travel up the Wulik or Kivalina Rivers.

This site is sufficiently elevated and close enough to the sea that the community can easily watch for whales that pass close by the shoreline. With a good spotting scope, several miles of coastline are visible from the western edges of the site.

The north bank of the Kivalina River should also be accessible by foot from the Tatchim Isua site by walking southeast along the west side of the lagoon and crossing Imnakuk Creek.

Constructed gravel roads from the new village site at Tatchim Isua may be expensive to construct. This high cost prohibits many roads from being built around the village. We anticipate that in addition to the Chukchi Sea access road west from the village site, that there may be one additional road of similar structural section to the east from the village to access the solid waste dumpsite. Due to lack of specific information regarding the location of these sites, no exact length for this road can be determined. However, a length in excess of 10,000 ft is anticipated because of the requirement to site any solid waste dump at least that distance from any runway accessed by turbojet aircraft. Figure 9 shows the proposed road.

#### **3.7.4.2 Goods & Supplies – Tatchim Isua**

The main source of goods and supplies for the new village should be by barge. A new barge landing and access road to the village

should be designed and constructed west of the village site on the Chukchi Sea.

A barge landing on the sea may expose a moored barge to the strong wind and wave action developed over the long westerly fetch existing at the outer side of the barrier spit. This may mean that the barge may have to wait to moor and unload during bad weather.

The location of an airstrip is unknown at this time. Additional information will be gathered during the Stage II study to determine the best location and design considerations for a new airstrip. Until a suitable location is found, the community should use the existing airstrip and ferry goods across the lagoon to utilize the new village access road.

For the purposes of this study and the cost estimate, we have assumed the runway should be located approximately half a mile west of the site.

#### **3.7.4.3 Air Transportation – Tatchim Isua**

Air transportation for the new village should be through the existing airstrip until a new airstrip is located, designed and constructed. Access to the existing airstrip requires boat travel along the beach. This may make emergency medical evacuation difficult, and in some instances necessitate the use of a helicopter to airlift injured people from the village itself.

Any future airport built specifically to serve the village should be sited considering soil conditions and required depth of gravel, distance from the new village, distance from the solid waste dump, wind conditions and flight path safety. Figure 11 shows a potential location for the new airport, but further investigation into this site will be needed.

#### 3.7.4.4 Roads & Streets - Tatchim Isua

The road layout within the community is expected to closely reflect the plan in Appendix G for the Phase I study report. Roads should be designed on a grid system to maximize flow of traffic and access to all portions of the new community.

The soil conditions of the Tatchim Isua site vary with the distance east from the bluff side of the site. For approximately 400 ft, a dryer soil consisting of limestone fragments in a silt matrix provides good support for both buildings and roads. From a distance of 400 ft east of the bluffs to the east, the site gradually rises and the soils are composed of wet, clayey silt with frozen ground encountered at approximately 3 ft. These two different soil conditions may dictate two different depths of gravel for the road/building prisms. The regions near the shoulder of the bluff are underlain by more gravelly soils and are more easily utilized for installation of utilities in the roadbed than are areas underlain by silty, ice-rich soils.

The location of the Tatchim Isua site and its soil conditions make road construction difficult and expensive. It is anticipated that there should be as few roads as possible outside the village to access the new airstrip, solid waste facility and lagoon boat moorage area. Preferably, two or more of these facilities should be located along the same road, to reduce the amount of road development necessary.

#### 3.7.5 □ Native Allotments

There are seven Native allotments along the northeast end of Kivalina Lagoon (see Figure 11). One of these allotments impinges slightly on the south corner of the Tatchim Isua townsite. Potential barge landing, landfill and sewage treatment sites abut against two of the Native allotments.

#### 3.7.6 □ Relocation Costs – Tatchim Isua

Design and construction administration are not included in the construction cost estimate below. The cost estimate to build a new village site at Tatchim Isua is **\$154.9 million**. Detailed costs are included in Appendix A. A summary is included below:

Site work and Airport Construction	\$70,400,000
Erosion Protection	\$231,000
Construction Camp	\$606,000
Power and Fuel	\$5,292,000
Move Buildings	\$1,125,000
New Buildings	\$52,690,000
Water/Sewer System and Landfill	\$21,521,638
Transportation System	\$3,056,000
<b>Total Cost</b>	<b>\$154,900,000</b>

#### 3.7.7 □ Recommended Plan for Tatchim Isua

The Tatchim Isua area is located about 9 miles north of the existing village site, approximately ¼ mile north of the extreme north end of the Kivalina Lagoon. During investigation in August 2004, the site showed some good gravel areas on the south slopes above the shoulder of the bluff.

Figure 11 shows the recommended configuration of infrastructure for Tatchim Isua. Access to the site would be from a road and barge landing area located on the Chukchi Sea. The sewage lagoons would be located along this road. The airport facility would be located west of the townsite.

However, if wind studies show that the location is not appropriate, then an alternative locations would have to be considered. The alternative location would most likely be the same airport location as described for Imnakuk Bluff (approximately 2 miles east of Tatchim Isua, on the lower slopes of the hills north of the site). It is anticipated that this area should provide a better subgrade on which to base the 150 ft X 4,000 ft runway. An additional 10,500 lf of access road from the site may be needed. The landfill could be sited along the airport access road, and still maintain the 10,000 lf of separation between runway and landfill.

The raw water source for the Tatchim Isua Site has not yet been determined. However, the water resource report (Appendix A) recommends the Asikpak River as a source . Cost estimates will be based on this assumption.

The proposed landfill is located 1.4 miles east of the site.

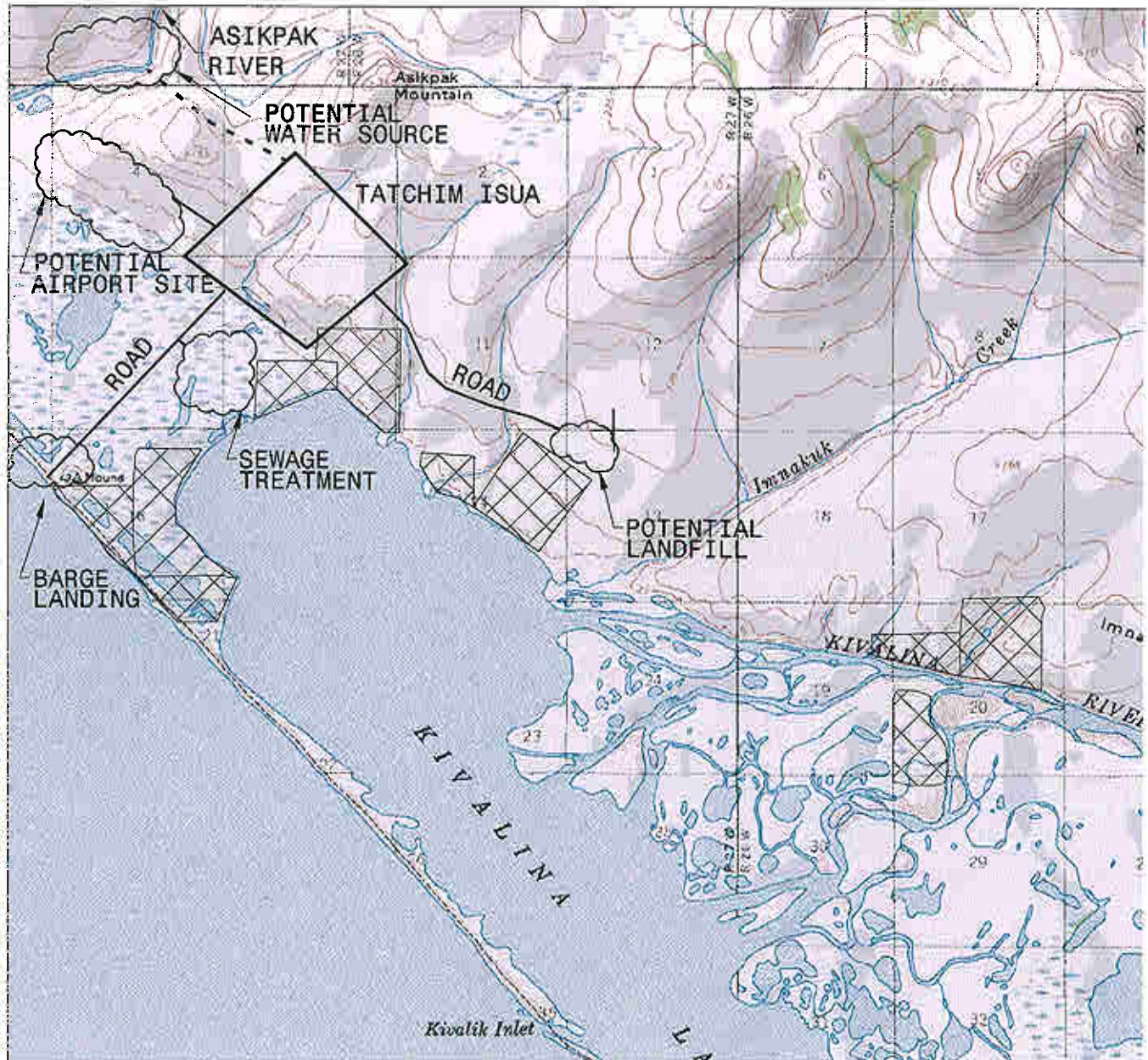
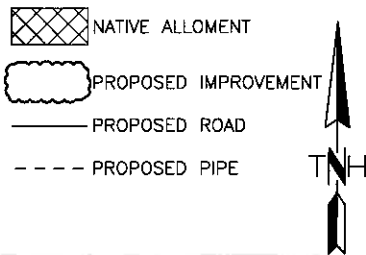
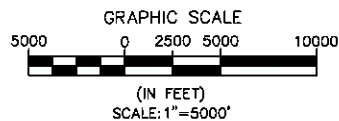
The sewage lagoon should be located to the west of the townsite, along the small stream that drains into the wetlands below the site. The stream can be used as a surface discharge stream for the treated lagoon effluent. This may create a shorter length of sewage pump line than some other sites and access the best discharge route in the area, for this site.

XREF's/IMAGES USED FOR THIS DWG:

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**FIGURE 11**

**TATCHIM ISUA CONCEPTUAL LAYOUT**

DESIGN BY: MEW	DATE: 6/16/06
DRAWN BY: JT	PROJECT No: 03003.007
SCALE: 1" = 5000'	REV. --
CAD DWG FILE:	
FIELD BOOK: -	SHEET <b>1</b> OF <b>1</b>
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